The OIL BURNER OWNER'S GUIDE

POCKETBOOK FACTS *of value to:*

- **OIL BURNER OWNERS**
- **OIL BURNER DEALERS**
- **OIL BURNER MANUFACTURERS**
- **FUEL OIL DISTRIBUTORS**

INDEX

Foreword

IN preparing this Guide we have endeavored to set forth practical oil heating facts which are intelligible to everyone interested in oil heat.

We have included:

(a) Fundamental principles of combustion.

(b) Fundamental information on fuel oil characteristics developed at Shell's Oil Burner Testing Laboratories.

(c) Useful tables to aid in checking fuel costs.

(d) Suggestions on how to reduce your fuel oil bill.

It is the purpose of this Guide to help promote a more practical knowledge of oil heating and a better understanding of those factors which make for economy in the use of oil fuel.

OIL BURNER OWNER!

You will find of particular interest to you, the advice on the selection of the correct fuel for your oil burner and the numerous hints on saving fuel which will actually PUT MONEY IN YOUR POCKET.

OIL BURNER MANUFACTURER!

You will find of especial value to you the data pertaining to "Proper Fuel Oil Specifications" for the type of burner which you manufacture.

OIL BURNER DEALER!

You, too, will be interested in the fuel oil specifications and the bearing which they have on oil burner performance, also the valuable estimating tables given throughout the Guide.

FUEL OIL DISTRIBUTOR!

The pages dealing with fuel oil characteristics and their application to the various types of domestic oil burners will give you up-to-the-minute information on the product which you handle and will prove to you the value of quality and uniformity in fuel oils.

FUNDAMENTAL PRINCIPLES OF FUEL OIL COMBUSTION

AN understanding of the various principles involved in the operation of your oil burner requires some knowledge of fuel oil and how it behaves when set on fire. The study of this subject involves many intricate details, but here we are concerned primarily with fundamental or basic facts.

DEFINITION OF COMBUSTION

In chemistry textbooks you will find combustion defined as a chemical reaction between any substance and oxygen which takes place rapidly enough to produce heat or light. In other words, combustion is the same thing as burning. When oil burns, the carbon and hydrogen, of which it is chiefly composed, chemically combine with the oxygen in the air to form new compounds having entirely different properties from those of the air and oil.

COMPOSITION OF AIR AND OIL

Fuel oil is composed of about 15 per cent hydrogen and 85 per cent carbon; thus it is called a hydrocarbon compound. Air contains about 21 per cent oxygen and 79 per cent nitrogen. Nitrogen, being a very inert gas, does not enter into combustion reactions.

PRODUCTS OF COMBUSTION

From the standpoint of the chemist your oil furnace is nothing more than a miniature chemical factory. The raw materials entering this "factory" are fuel oil (Carbon-Hydrogen) and air (Nitrogen and Oxygen), while the finished products, as shown in the sketch on the following page, consist chiefly of water (H_2O) and carbon dioxide (CO_2).

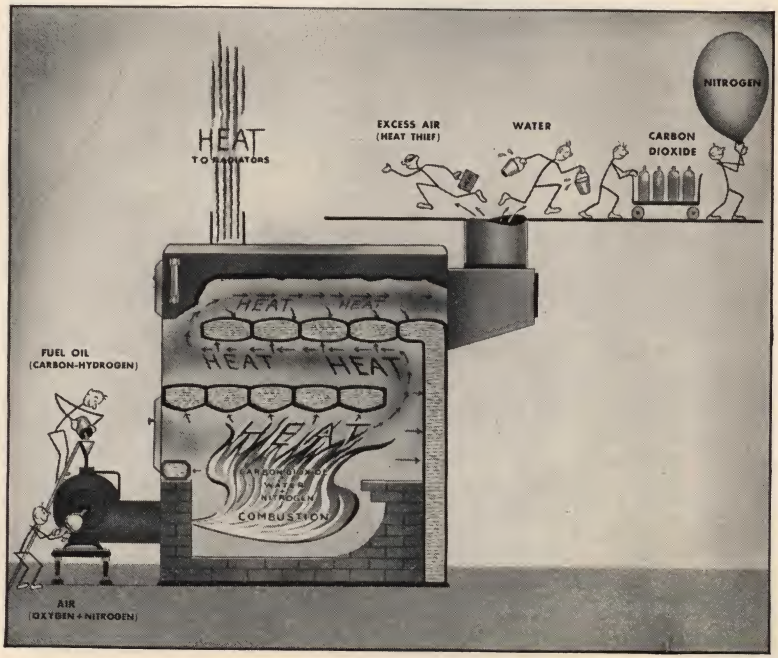
As a matter of fact, for every pound of fuel oil you burn, a little more than one pound of water and three pounds of carbon dioxide are produced.

Carbon dioxide is a colorless gas which, if solidified, you would probably recognize as "dry ice." The water which forms is rarely noticed by the average oil burner owner since it passes off through the chimney in the form of vapor or steam.

If considered purely from a chemical viewpoint, one might say that the *heat* produced is merely a by-product of these chemical changes which take place in the raw materials. However, this *"by-product"* is what you pay for when you buy oil from your fuel oil supplier, and naturally you want to utilize as much heat as possible from every drop of fuel oil you buy. In order to accomplish this there are certain fundamental rules which have to be observed.

EXCESS AIR

It requires about 14 pounds (183 cu. ft.) of air to burn one pound of fuel oil. Any amount of air above that actually required to burn the oil is considered excess air, and since it must be heated to the same temperature as the products of combustion, when it leaves your boiler or furnace it carries this heat up the chimney where it is



wasted. Therefore the more excess air used to burn the oil, the greater these heat losses will be.

In actual practice, it is almost impossible to supply just the right amount of air required to burn the oil and no more. In fact, a small amount of excess air must always be employed as a safeguard against forming carbon monoxide or smothering out the fire, in case of downward draft fluctuations. However, a large amount of excess air is definitely undesirable.

CARBON DIOXIDE VS. EXCESS AIR

It is possible to find out whether the proper amount of air is employed in burning the oil by determining the percentage of carbon dioxide (CO_2) in the flue gases leaving the furnace after combustion is completed. Your oil burner service man uses a portable gas analyzer to make this determination.

Table 1 shows the relationship between the carbon dioxide in the flue gases and excess air when burning fuel oil. The approximate fuel losses due to excess air are also given. The latter figures show *preventable* losses only, based on the combustion efficiency of the burner alone, assuming a constant stack temperature of 500° F., and thus are different from the overall efficiency data given in Table 8, which apply to both burner and boiler or furnace.

PREVENTABLE FUEL LOSSES DUE TO EXCESS AIR

TABLE 1

Percent Carbon Dioxide in Flue Gases	Percent Excess Air	Percent Preventable Fuel Loss
15	0	0
14	8	.4
13	15	1.1
12	24	1.7
11	36	2.5
10	50	3.5
9	67	4.7
8	90	6.2
7	120	8.2
6	155	10.7
5	200	14.2
4	275	19.4

In actual service the air setting on the average up-to-date domestic oil burner should be such as to give the highest carbon dioxide reading possible without producing a smoky fire. Recognizing the percentage of carbon dioxide in the flue gases as an important index of the quality of the combustion performance of a burner, the Federal Housing Administration requires that the burner shall be capable of producing and maintaining a carbon dioxide reading of not less than 8 per cent (Commercial Standard CS75-39, effective November 1, 1939,) on all domestic burner installations financed by this government agency.

SMOKE

Fuel oil, if properly prepared for combustion, will always burn with a smokeless flame. Smoke is usually the result of a poor air and oil mixture, and probably rates next to excess air as a cause of excessive fuel consumption. A smoky fire deposits soot on the heat absorbing surfaces of the furnace or boiler, thus having an insulating effect which greatly reduces the rate of heat transmission through the iron. It is estimated by some authorities that a coating of soot one-eighth of one inch thick on the boiler heating surfaces can cause an increase in fuel consumption of as much as 25 per cent.

PROPER FUEL OIL SPECIFICATIONS FOR VARIOUS TYPES OF OIL BURNERS

Much confusion has existed in the past regarding fuel oil specifications. Shell was first to realize that this confusion indicated a great need for a closer understanding between oil burner manufacturers and oil companies. Accordingly, Shell formulated, and has carried out since 1929, an uninterrupted program of fuel oil and oil burner research in collaboration with leading burner manufacturers.

Because of this extensive work Shell engineers are confident that Shell produces and markets fuel oils which will assure the oil burner owner maximum satisfaction in oil heating.

From the standpoint of burner operation, Shell's experience in the Shell Oil Burner Testing Laboratories has shown that the most important characteristics of domestic fuel oils are as follows:

TESTS FOR QUALITY

LOW CARBON RESIDUE

Range oil burners and both pot and rotary vaporizing type oil burners are particularly sensitive to oils which are shown by test to have high carbon residue (the solids remaining after fuel is burned.)

Oils which are shown by test to have high carbon residue cause accumulations of carbon to form on the vaporizing surfaces when subjected to the high temperatures necessary to vaporize the oil.

In this connection it should be mentioned that a distinction must be made between residual carbon, which forms due to the high carbon residue of the oil, and the carbon and soot which form as a result of poor combustion due to improper mixing of the air with the oil vapors. Unless this distinction is recognized between the two types of deposits, you may, in some instances, be blaming the oil for a condition for which it is not responsible.

UNIFORM VISCOSITY

Small-sized pressure atomizing domestic burners demand oils which are uniform in viscosity, or body, because a change in the body of the oil will alter the burning rate and disturb the proportions of oil and air necessary for perfect combustion. The viscosity of an oil not only affects the output of a nozzle but it also affects the angle of spray. Some nozzles are more sensitive than others in this respect; in some instances a complete collapse of spray may accompany an increase in viscosity. As a general rule we recommend for use in pressure atomizing domestic burners an oil which has a viscosity of not more than 45 seconds Saybolt Universal at 100° F. Your fuel supplier should know the viscosity of the oil which he is furnishing to you.

FREEDOM FROM SEDIMENT AND WATER

Any silt, sand, metal particles, scale, rust or other foreign matter in the oil will clog oil burner nozzles and strainers. Abrasive impurities

will eventually result in excessive wear of valves and pumps. A recent survey of oil burner service calls revealed that 18 to 23 per cent of all calls were necessitated through the use of dirty and non-uniform oils. Shell Fuel Oils are filtered to free them of sediment and water and every precaution is taken in handling the product to prevent contamination in lines, tanks, trucks, etc. This assures the delivery of absolutely clean fuel oil to the customer's tank.

SMOOTH PROGRESSIVE DISTILLATION

The correct distillation is a particularly important characteristic of a fuel oil because of its bearing on its ignition and burning qualities. In the past it has been erroneously supposed that the ignition characteristics of an oil depended upon its flash point. Recent investigations at Shell's Burner Testing Laboratories have disclosed that the ignition of a fuel oil is analogous to the lighting of an old coal fire such as your father or grandfather might have built before the days of automatic oil heating. In an oil there should be the readily ignitable "light volatile fractions" (light kindling, such as paper or shavings) which start burning immediately by the application of an electric spark and give off sufficient heat to vaporize and ignite the next heavier fractions (analogous to the sticks of wood or charcoal). These in turn burn and give off still more heat until the temperature is high enough to ignite the heaviest fractions (the coal bed).

A balanced fuel oil, made to specifications, is a complete ready-built "fuel bed" combining within itself just the right proportions of light, intermediate and heavy fractions to provide all the necessary elements for instantaneous ignition, smooth progressive volatilization and clean efficient combustion.

Other characteristics of fuel oil which are specified frequently but which are relatively unimportant are:

GRAVITY

In the light of the above the gravity of an oil has no effect on burner operation.

FLASH POINT

As explained above, the flash point of an oil is not a true indication of ignition quality.

HEAT CONTENT

The difference in heat content between any one grade and the grade next to it is so slight that it can be considered negligible. Where

no price differential exists, the use of the lighter, more highly refined oil will prove the more economical.

SULFUR

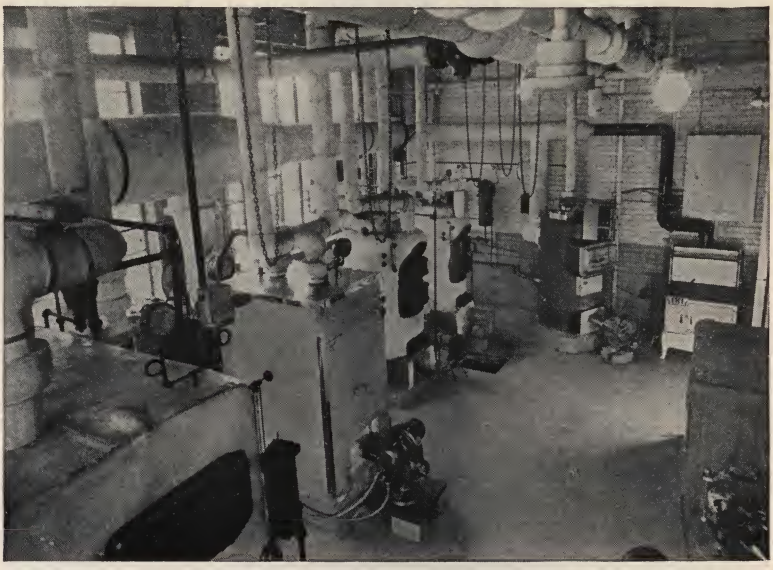
The importance of sulfur content is frequently over-rated. Its presence has no harmful effects provided the temperature of the flue gases does not fall below the dew point (about 130° F.). There are a very few special industrial applications where it is necessary to limit the percentage of sulfur.

DOMESTIC FUEL OIL BURNERS

The table shown below will assist you in identifying the various types of Domestic Oil Burners and in selecting the correct grade of fuel oil to insure satisfactory burner performance.

TABLE 2

GENERAL TYPE	SPECIFIC TYPE	DRAFT	GRADE OF FUEL OIL	NECESSARY FUEL OIL CHARACTERISTICS
VAPORIZING	Range	Natural	Range Fuel	Even distillation range Carbon residue—nil Good ignition characteristics
	Pot	Natural	1 or 2	Balanced distillation Low carbon residue Good ignition characteristics
		Mechanical	1 or 2	Balanced distillation Low carbon residue Good ignition characteristics
	Vertical Rotary Vaporizer	Mechanical	2	Balanced distillation Low carbon residue Good ignition characteristics
ATOMIZING	High Pressure Mechanical	Mechanical	2 or 3	No sediment Uniform low viscosity Good ignition characteristics
	Low Pressure Air	Mechanical	2 or 3	Low sediment Not too high viscosity Good ignition characteristics
	Vertical Rotary Atomizer	Mechanical	2 or 3	Low sediment Not too high viscosity Good ignition characteristics
	Horizontal Rotary Cup	Mechanical	2 or 3	Not too high viscosity Low sediment, Max. 1.00% B.S. and W.



Inside view of Shell's Oil Burner Testing Laboratories where all types of domestic oil burners are tested under actual service conditions to determine the quality of oil that must be supplied to each of the various types of burners in order to insure trouble-free and uninterrupted burner service.

HOW TO SELECT THE CORRECT FUEL OIL FOR YOUR BURNER

From the foregoing, you can see that the selection of the correct fuel oil for your burner is a matter of great importance, a matter worthy of careful consideration and the best advice obtainable. You call your lawyer for legal advice. You call your banker for financial advice. Call upon a reliable oil company for heating oil advice.

Select your oil supplier on the basis of—

1. Reliability.
2. Uniform product.
3. Knowledge of the necessary fuel oil characteristics.

Shell operates six modern refineries producing specially filtered fuel oil to rigid specifications set up by Shell's Burner Testing Laboratories. Shell Fuel Oils conform to the latest commercial standard specifications adopted by the U. S. Bureau of Standards.

PHOTO COURTESY HOUSTON CHRONICLE

AUTOMATIC FUEL OIL DELIVERIES

THE DEGREE DAY METHOD

It has been found that the quantity of fuel oil consumed is proportionate to the number of degrees that the outside temperature falls below 65° F. This fact presents a convenient method of estimating oil consumption by taking into account the effect of varying temperatures on daily consumption. This system of calculation is known as the Degree Day Method and is applied by Shell to provide a highly efficient system of fuel oil deliveries; a "Keep-Filled" Service, which insures the customer of an adequately filled tank at all times, eliminates the necessity of continual checking of the tank during the heating season.

The application of the Degree Day System is relatively simple. At the depot, accurate thermometers are consulted daily to determine maximum and minimum temperatures for each twenty-four hour period. The mean daily temperature is computed by adding together the maximum and minimum temperatures for the day, and dividing by two. The number of Degree Days for the day is computed by subtracting the mean temperature from 65° F. The consumption rate of each fuel oil account in Degree Days per gallon is established by dividing the number of Degree Days for any given period by the gallons consumed during the same period. Once the consumption rates for all accounts are determined, the number of gallons used during any given period by any account served may be calculated at the depot. Shell uses a card system which provides a running record of gallons delivered, gallons in the customer's tank after delivery and the Degree Days which determine when the next delivery must be made.

The Degree Day System banishes tank-checking and "out-of-oil" calls, provides perfect service with a minimum number of deliveries, thereby benefiting both customer and supplier.

HEATING COSTS

SEASONAL REQUIREMENTS

Oil heating is the most economical form of fully automatic domestic heating. You can prove this to your own satisfaction by referring to the table shown below. The figures given are calculated for average heat contents and approved heating efficiencies. Multiply the prevailing local fuel prices by the figure denoting your seasonal requirements.

If you follow the recommendations and suggestions listed in this booklet under the following headings, you can be assured of worthwhile savings in heating costs by burning oil as against other forms of fuel:

(a) Inside temperature maintained (See page 16)
(b) Oil burner and heating plant efficiency (See page 18)
(c) Constructional features of your house (See page 23)

YEARLY FUEL REQUIREMENTS AND EQUIVALENTS TABLE 3

Tons of Coal or Coke	Tons of Stoker Coal	Gals. No. 2 or 3 Oil	Therms Gas	Thousand Cu. Ft. Manf'd Gas	Thousand Cu. Ft. Natural Gas	Thousand Cu. Ft. Mixed Gas
5	4.2	700	924	168	92	115
6	5.0	840	1108	202	111	138
7	5.8	980	1293	235	129	162
8	6.7	1120	1478	269	148	185
9	7.5	1260	1663	302	166	208
10	8.3	1400	1847	336	185	231
11	9.2	1540	2032	370	203	254
12	10.0	1680	2216	403	222	277
13	10.8	1820	2401	437	240	300
14	11.7	1960	2586	470	259	323
15	12.5	2100	2771	504	277	346
16	13.3	2240	2955	538	296	369
17	14.2	2380	3140	571	314	392
18	15.0	2520	3325	605	333	415
19	15.8	2660	3509	638	351	439
20	16.7	2800	3694	672	369	462
21	17.5	2940	3879	706	388	485
22	18.3	3080	4063	738	406	508
23	19.2	3220	4248	773	425	531
24	20.0	3360	4433	806	443	554
25	20.8	3500	4618	840	462	577
30	25.0	4200	5542	1007	554	693
35	29.1	4900	6465	1175	647	808
40	33.3	5600	7389	1345	739	924
45	37.5	6300	8312	1511	831	1040
50	41.6	7000	9236	1679	924	1155

MONTHLY CONSUMPTION

The application of your season's requirements to the following table will give the approximate gallons of fuel oil you may expect to burn each month of the heating season, providing weather conditions are average or "normal."

TABLE 4

Average Yearly Requirements Gallons	APPROXIMATE MONTHLY REQUIREMENTS IN GALLONS								
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
1500	22	98	172	255	278	255	225	120	75
2000	30	130	230	340	370	340	300	160	100
2500	37	162	288	425	463	425	375	200	125
3000	45	195	345	510	555	510	450	240	150
3500	52	228	402	595	648	595	525	280	175
4000	60	260	460	680	740	680	600	320	200
5000	74	324	576	850	926	850	750	400	250
10000	148	648	1152	1700	1852	1700	1500	800	500
15000	222	972	1728	2550	2778	2550	2250	1200	750

EFFECT OF WEATHER

It is interesting to note the important effect that outside temperature has on oil consumption. The following table shows approximate daily consumption at various average outside temperatures.

TABLE 5

Average Yearly Requirements Gallons	APPROXIMATE REQUIREMENTS IN GALLONS FOR ANY DAY AT AVERAGE OUTSIDE TEMPERATURES OF						
	50°	40°	30°	20°	10°	8°	−10°
1500	3½	5½	8	10	12½	14½	17
2000	4½	7½	10½	13½	16½	19½	22½
2500	5½	9½	13	17	20½	24	28
3000	7	11	16	20	24½	29	33½
3500	8	13	18	23½	28½	34	39
4000	9	15	21	27	32½	38½	44½
5000	11	18½	26	33½	41	48	56
10000	22	37	52	67	82	96	112
15000	33	55½	78	100½	123	144	168

CONTROL OF HEATING COSTS

In oil heat you have a definitely economical form of automatic heating, providing the *controllable factors which have a great effect on fuel consumption* are carefully considered, and the necessary steps taken to improve conditions.

INSIDE TEMPERATURES

High inside temperatures are wasteful, unnecessary and even unhealthful. A temperature of 70° with the proper humidity is considered best. The table below shows how much fuel oil is wasted if you keep your thermostat at 75° F. or 80° F. instead of 70° F.

TABLE 6

Average Yearly Requirements in Gallons	OIL WASTED YEARLY DUE TO THERMOSTAT SETTINGS OF	
	75° F.	80° F.
1500	214 gals.	428 gals.
2000	286 "	572 "
2500	357 "	714 "
3000	428 "	856 "
3500	500 "	1000 "
4000	571 "	1142 "
5000	714 "	1428 "
10000	1428 "	2856 "
15000	2143 "	4286 "

SAVE BY LOWERING NIGHT TEMPERATURES

If you maintain a lower temperature during the night a considerable saving can be effected. The table below shows the savings in percent that result from lowering night temperatures various amounts and for various periods of time. The figures given were calculated for an inside *DAY* temperature of 70° F. and an average outside temperature for the heating season of 35° F.

TABLE 7

Lowered Night Temp. ° F.	PERCENT SAVINGS IN FUEL OIL WHEN THERMOSTAT SETTING IS LOWERED AT NIGHT FOR A PERIOD OF			
	4 Hrs.	8 Hrs.	12 Hrs.	16 Hrs.
70	0	0	0	0
65	2½%	5%	7½%	9½%
60	5%	9½%	14½%	19½%
55	7½%	14½%	21½%	28½%
50	9½%	19½%	28½%	38½%

Shell Engineers adjusting burner prior to conducting a heating efficiency test.

Factors which must be taken into account when considering INSIDE TEMPERATURE, are humidification and thermostat sensitivity. Both humidification and sensitive thermostatic control have the effect of increasing heating economy.

When the proper relative humidity (about 40%) is maintained, a lower temperature will provide comfort. As we have shown, lower inside temperatures mean lower fuel consumption.

Sensitive thermostatic action results in more even heating and prevents stratification of the air, thereby providing comfort with a lower average thermostat setting.

OIL BURNER AND HEATING PLANT EFFICIENCY

The overall efficiency of your heating plant depends upon a number of factors, which may be conveniently grouped under three headings:

Installation. (See below.)
Adjustment of oil burner. (See page 19.)
Annual servicing. (See page 21.)

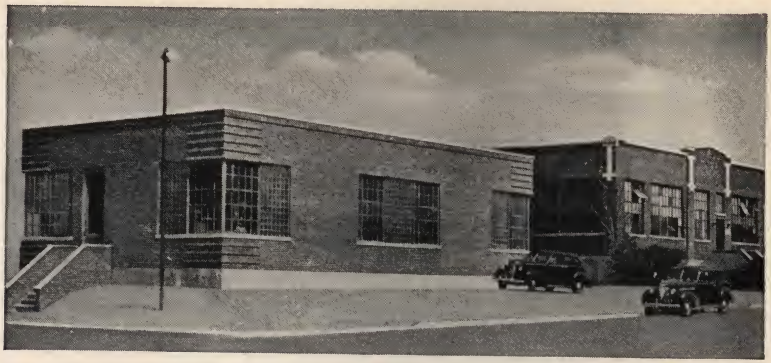
OIL BURNER INSTALLATION AND ADJUSTMENT

INSTALLATION

1. *Boiler—type and size*—For efficient heat generation the boiler must be the correct type for oil burning and large enough to carry the load without forcing.

2. *Piping layout*—Poorly pitched and trapped lines mean inefficient heating.

3. *Size and location of radiators*—Correct amount of installed radiation to provide balanced heating. Correct type of radiator valves should be in good working order.



The Shell Oil Burner Testing Laboratories, Sewaren, N. J., where many of the nation's oil burner manufacturers frequently bring their problems for Shell chemists and engineers to solve. These were the first and largest laboratories of their kind in the world.

4. *Insulation*—To reduce radiation losses, boiler, mains and returns should be properly insulated.

5. *Oil-burner*—Type should be suited to the boiler and it must be large enough to carry the load.

6. *Shape and size of combustion chamber*—Suited to the flame and correct size for the radiation load.

7. *Size and spray angle of nozzle*—Correct size for the load and suited to the shape of the fire box.

8. *Type and location of thermostat*—To provide sensitive and accurate temperature control.

If you are interested in checking up your heating plant along the lines suggested, consult your oil burner dealer.

ADJUSTMENT OF OIL BURNER

1. *Regulation of air-oil mixture for good combustion.* If economical heating is to be expected, combustion efficiency must be high. Combustion efficiency depends upon the adjustment of your oil burner to produce a good air-oil mixture as indicated by high Carbon Dioxide in the flue gases and low stack temperature. Such a mixture will mean a minimum "stack loss" (heat lost in flue gases.) Your oil burner dealer or oil supplier should be equipped to run a test of this nature for you, so that you may be assured that your oil burner is properly adjusted for maximum efficiency.

STACK LOSS

Example: Let us assume that your burner is poorly adjusted and a simple combustion test shows the Carbon Dioxide to be 6.5% and the stack temperature 700° F. Table 8 indicates a stack loss of 32.3% for this adjustment.

STACK LOSS IN PERCENT — TABLE 8

Carbon Dioxide (CO_2)	STACK TEMPERATURE IN F.°							
	300	400	500	600	700	800	900	1000
Percent								
15.0	10.7	12.7	14.8	16.8	18.8	20.8	22.8	24.8
14.5	10.9	12.9	15.0	17.1	19.2	21.2	23.3	25.2
14.0	11.0	13.1	15.3	17.4	19.5	21.6	23.8	25.7
13.5	11.1	13.4	15.6	17.7	20.0	22.0	24.3	26.4
13.0	11.3	13.5	15.8	18.1	20.5	22.5	24.9	27.0
12.5	11.5	13.8	16.2	18.4	20.7	23.1	25.5	27.8
12.0	11.6	14.0	16.5	18.8	21.4	23.7	26.2	28.6
11.5	11.8	14.4	16.8	19.3	22.0	24.3	26.9	29.5
11.0	12.1	14.7	17.3	19.8	22.6	25.1	27.8	30.5
10.5	12.4	15.0	17.8	20.5	23.3	25.8	28.8	31.5
10.0	12.6	15.4	18.3	21.2	24.0	26.8	29.7	32.6
9.5	12.9	15.7	18.8	21.8	24.8	27.8	30.8	33.8
9.0	13.3	16.3	19.4	22.6	25.8	28.8	32.0	35.2
8.5	13.6	16.8	20.1	23.5	26.8	30.0	33.5	36.8
8.0	14.0	17.5	20.9	24.5	28.0	31.5	35.0	38.5
7.5	14.5	18.3	21.8	25.5	29.3	33.0	36.8	40.5
7.0	15.1	18.9	22.9	26.8	30.8	34.8	38.8	42.5
6.5	15.7	19.8	24.0	28.2	32.3	36.7	41.0	45.0
6.0	16.5	20.8	25.5	29.8	34.3	39.0	43.4	47.9
5.5	17.3	22.2	27.0	32.0	36.7	41.5	46.5	51.3
5.0	18.3	23.6	29.0	34.3	38.6	45.0	50.2	55.4
4.5	19.5	25.5	31.4	37.3	43.2	49.0	54.8	60.3
4.0	21.1	27.6	34.2	40.7	47.4	53.7	60.5	67.0

Now assume that your oil-burner man re-adjusts your burner and raises the Carbon Dioxide to 10.0% and reduces the stack temperature to 600° F. This means that simply by improving the adjustment of the burner, he has reduced your stack loss from 32.3% to 21.2%, a difference of 11.1%. This change is equivalent to a reduction in oil consumption of approximately 14%.

2. *Draft regulation.* In order that your oil burner may run efficiently at all times it is necessary to control any conditions of variable or excess draft. Your oil burner dealer should be in a position to furnish and install some one of the many good makes of draft regulators now on the market.

ANNUAL SERVICING

SYSTEMATIC SERVICING HINTS

Just as the automobile manufacturer recommends regular conditioning for a car, so the manufacturer of heating equipment advises a limited amount of systematic conditioning for hot water and steam heating plants.

1. *Removal of Soot from Boiler Flues*

The soot deposited on the heating surfaces of the boiler, the surfaces coming in contact with the products of combustion, should be removed by means of a wire brush and scraper. This service can be rendered by oil burner service companies, who have available power driven vacuum cleaners. The vacuum cleaning method is especially recommended for warm air furnaces because all of the carbon and dirt removed from the heating surface and warm air ducts is delivered to the cleaning machine located outside of the house. Even a very thin coating of carbon acts as an insulating material, and this should be removed at least once each heating season.

In order to determine just what effect operating a burner with a smoky flame would have on the overall efficiency, tests were recently completed by Shell's Oil Burner Testing Laboratories. First, the efficiency tests were conducted immediately after the boiler had been thoroughly cleaned of soot. Then the burner was adjusted to produce a smoky flame, and was allowed to operate thirty-two hours under these conditions. The overall efficiency (the total useful heat obtained from the oil burner) decreased two per cent, and the temperature of the stack gases increased from 620° F. to 665° F. This increase in stack temperature showed that the heat is not being utilized in increasing the temperature of the water, but is escaping through the stack and is lost. After operating this same boiler eighty hours under smoky conditions, the efficiency decreased to 63.7%, or a total loss of 5%, while the stack temperature increased to 720° F., or an increase of one hundred degrees. This increase in stack temperature showed conclusively that the boiler was absorbing less and less heat as the coating of soot on the heating surfaces became thicker. From these figures it is easy to understand why it is important to adjust a burner so that it produces a clean flame, and, consequently, deposits a minimum amount of carbon on the heating surfaces.

2. *Removal of Scale from Inside Surfaces of Heating System*

A scale or deposit of grease and sediment from the pipe, radiators and fittings collects inside the boiler, and the use of hard or untreated water further aggravates this condition. This scale or deposit forms an insulation and reduces the heating efficiency. It should be removed after each heating season by the following method:

Drain the water completely from the boiler (after burner switch has been set to "Off" so that burner will not operate). Open the fill plug on the top of boiler and pour in the recommended amount of a reliable boiler cleaning compound. When this is used, the boiler should be refilled and operated several hours, allowing the mixture of water and cleaner sufficient time to thoroughly clean the surfaces. Then drain the mixture completely and wash the boiler thoroughly with fresh water. After a thorough rinsing, fill the boiler completely with water. By keeping the boiler completely filled when not in use, air is excluded and rust prevented.

3. *Fill Oil Supply Tank*

It is recommended that oil supply tanks be kept filled during the summer to prevent condensation of moisture and rusting of the interior surfaces, which might later interrupt service and damage equipment.

If the tank is located out of doors, it should be kept full for another reason of even greater importance. Heavy summer rains frequently "float" an empty tank from its foundations, damaging connections and involving serious repair costs.

4. *Inspection, Cleaning, and Lubrication of Burner*

To insure uninterrupted burner service, it is highly important to have your burner cleaned and conditioned at regular intervals. This should include inspection of the fuel tank, controls, and ignition electrodes, cleaning of burner parts, lubrication of the motor, and the making of any needed adjustments.

Cleaning the fuel oil strainers in the burner itself, as well as the strainer located in the fuel supply line, should receive careful attention. If the burner is used for heating water during the summer as well as for heating the house in the winter, these strainers should be cleaned at least twice a year—once at the end of the winter heating season and then again after the summer hot water season is over. If

your burner is equipped with a fuel oil filter, it too should be inspected regularly and you should not wait until the filter element is completely clogged before replacing it with a new one.

Your burner service man will do this work for you for a fixed price. This may save the cost of emergency service calls at a time when you can least afford to be without heat service.

Many oil burner service organizations offer a yearly service plan at a fixed price, which includes summer overhauling, periodic inspections and all emergency calls.

Your automobile gets regular mechanical inspection and service—why not give your oil burner the same care?

CONSTRUCTIONAL FEATURES OF YOUR HOUSE

Heating costs are affected directly by the rate at which heat can pass through walls, floors, roof and glass areas, and by the amount of air entering the building through cracks or structural materials. The methods of reducing the rate of heat loss and infiltration are by the use of weather stripping, storm sash and insulating materials.

Weather Stripping is a relatively low cost method of reducing heating costs, and, in addition, it has value in minimizing drafts and in keeping out dust.

It shows greatest effectiveness when workmanship on other parts of the structure is poor. On a well-fitted window or door, weather stripping may reduce infiltration from 28% to 40%. On a poorly fitted window, the reduction may run from 63% to 78%.

Storm Windows. The transfer of heat through the glass and frames of windows, doors and skylights can be checked by the use of storm windows or double glazing with dead air space between the panes.

Storm windows offer a major opportunity for reduction of heat losses, particularly in buildings having proportionately large glass areas. Storm windows are effective only when the windows are tightly fitted to minimize air infiltration. A large air space between the windows is less effective than a more limited space. Where double glazing is employed, approximately one-half inch space shows best results.

Insulation. The transfer of heat through walls, roof and floors can be lessened by the use of thermal insulating materials of appropriate type and thickness.

These materials can be divided into two general groups—(1) fibrous or granular materials either in loose form or fabricated into soft flexible "quilts" or bats, (2) rigid boards in which the insulating material is bonded together. The differences in the insulating value of materials within the two groups are small. In general, the lighter the material, the higher its insulating value. The loose filler materials are best adapted to old construction as they may be poured or blown in. The quilts, bats and rigid boards are commonly used in new construction.

Insulation of the side walls and the roof are both effective in reducing fuel costs. However, in cases where it becomes necessary to choose between one or the other, it is generally agreed that roof insulation will afford a greater return from the initial investment than wall insulation.

With regard to roof insulation, it is best to apply the insulating material either on or in between the ceiling joists of the top story, unless it is desired to keep the attic warm in the winter, in which case the insulation would have to be applied to the roof itself.

Reduction in Fuel Costs. The possible reduction in annual fuel costs is usually the dominant factor in determining the type and degree of insulation to be used.

SAVE BY IMPROVEMENTS

The saving in fuel cost resulting from the use of any insulation is influenced by the original quality of construction. The poorer the original construction, the greater the return on the investment in insulation.

The average amount of insulation will pay from 20% to 50% per year on the original investment. A greater initial outlay will require a somewhat longer time to pay for itself. However, in the long run, the greatest return in dollars will come from the most effective insulation that can be installed.

Your local builder should be in a position to furnish details and prices on the various types of insulation, weather stripping and storm sash which can be applied to your house.

CHART OF FUEL SAVINGS DUE TO IMPROVEMENTS IN CONSTRUCTION TABLE 9

CONSTRUCTIONAL FEATURES	Approximate Fuel Savings Percent
Weather Stripping only	10-15
Storm Windows only	10-20
Storm Windows and Weather Stripping	15-25
Wall and Roof Insulation	20-30
Weather Stripping plus Wall and Roof Insulation	30-45
Storm Windows plus Wall and Roof Insulation	30-50
Weather Stripping and Storm Windows plus Wall and Roof Insulation	35-55

The savings are expressed in percentage of fuel required to heat a house not equipped with any of these features. The calculations are based on heat transfer data taken from the "Heating, Ventilating, Air Conditioning Guide" published by the American Society of Heating and Ventilating Engineers, with allowances being made for estimated heat losses due to necessary air changes. The range of savings given takes into consideration different types of construction and the effectiveness of various insulating materials. Consult your local insulating contractor who will supply an estimate of your actual full savings by use of insulation.

MISCELLANEOUS FUEL SAVING HINTS

1. Seal air leaks in furnace doors and brickwork to prevent entrance of excess air which results in heat loss through stack.

2. Single or double cloth window shades pulled down over each window during the hours of darkness will prevent loss of heat through thermal resistance; good fit of shades is important.

3. Close off sleeping room from hall and unused adjoining rooms during night.

4. When fireplace is not in use, be sure damper is securely closed.

5. Keep attic ventilators, trap doors or other openings closed during heating season if possible.

6. Clean or replace air filters periodically on warm air installations.

7. Close off radiators or registers in rooms not in use either temporarily or permanently.

8. Lower the thermostat setting to reasonable degree at night and when away from home for extended periods, as over week ends.

DOMESTIC HOT WATER SERVICE

Wherever there is a demand for the comfort and convenience of automatic heat there is usually an active interest in economical, dependable, automatic hot water service.

Hot water is an essential in every home, if a modern standard of living is to be maintained. The advantages of automatic operation are well known. It assures a tankful of water heated to the desired temperature without effort and ready for use when wanted without bothersome trips to the basement to light and turn out the fire.

Oil Burning Water Heater. Domestic hot water can be provided by means of any one of the following methods:

1. Power burner storage water heater. (Tank and burner in one unit.)
2. Kerosene, storage water heater. (Tank and burner in one unit.)
3. Indirect water heater installed on the boiler used for heating.

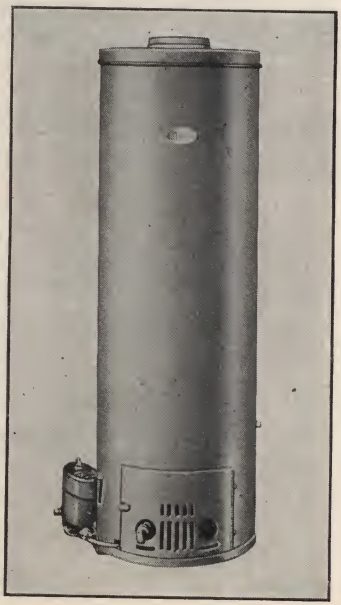
The type of equipment selected should depend upon individual conditions and requirements.

Automatic oil burning water heaters will supply hot water for ½ of the average cost of manufactured gas and about 1/7th of the cost of electricity.

Comparative Cost Chart. The following chart shows the number of gallons of water which can be heated for $1.00 with various fuels:

Oil or Kerosene (at 8¢ per gal.) . . . . . (1500 gallons)
Coal (at $12.00 per ton) (600 gallons)
Manufactured Gas (at $1.00 per 1,000 cu. ft.) . . . . . (460 gallons)
Electricity (at 2¢ per kilowatt hour) . . . . . (200 gallons)

The picture shows a self-contained, automatic kerosene burning water heater. A unit of this type with 30 gallon storage tank will supply sufficient hot water for the average small home and use only 5½ pints of fuel per day at a cost of 5½¢. (Range oil figured at 8¢ per gallon.)



SPACE HEATERS

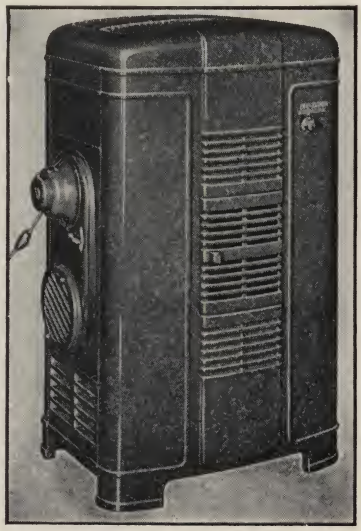
Oil burning space heaters came into common use only a few years ago, but they are rapidly gaining in popularity wherever central heating is not provided.

Almost 50% of American homes are heated by stoves. Many of these are of the old-fashioned hand-fired type using coal or wood. Space heaters offer these homes the conveniences of modern heating and bring the cleanliness and care-free comfort of oil heat within the reach of the most modest budget.

A medium size space heater with a heating capacity of 4,000 cubic feet (approximately three rooms) will consume only 2½ pints of oil per hour to maintain a temperature of 70° F. in zero weather. If it is run for twelve hours a day, the total cost will be only 30¢. (Figured for range oil at 8¢ a gallon.)

Space heaters render practical and economical the use of oil for small space heating of every description:

Small homes
City flats
Resort cottages
Offices
Garages
Restaurants
Stores
Service Stations



Ashes, dust, dirt and soot are eliminated, along with the drudgery of building fires each morning and the difficulty of maintaining comfortable room temperatures. The space heater furnishes the required amount of heat in Winter, Spring or Fall without work or worry. Just fill the tank with the fuel oil recommended by the manufacturer of your unit.

OIL BURNER ADVICE

For expert advice concerning the operation, mechanical condition, or repairs to your oil burner, you should consult an oil burner expert. If you are unable to find such a burner expert, your local Shell representative will recommend a reliable burner service organization.

FUEL OIL ADVICE

For expert advice on the characteristics, suitability, and performance of the fuel oil best adapted for your particular make of oil burner, consult fuel oil experts. Shell's local representatives are especially trained to give you complete fuel oil advice, regardless of the model and make of the burner you use. You will profit by consulting them.

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